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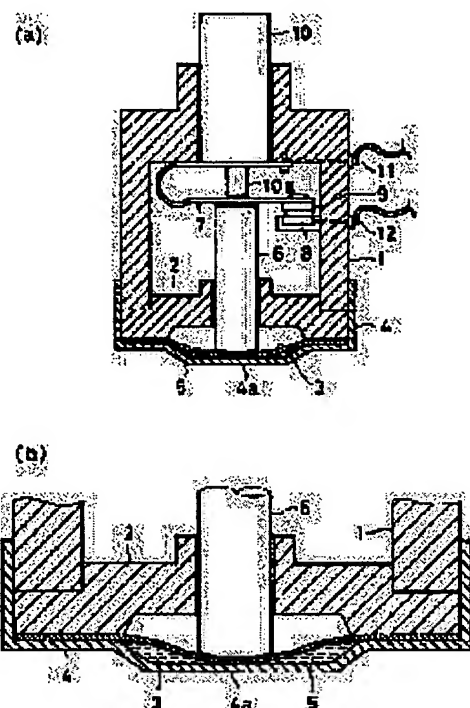
MATSUMOTO MITSUHIRO

(54) THERMOSTAT

(57)Abstract:

PROBLEM TO BE SOLVED: To quickly and accurately detect the temperature change of an object or substance being a temperature controlled subject and to avoid abnormal temperature fluctuation.

SOLUTION: A gap between a heat receiving part 4a arranged to come into contact with or come close to the object being the temperature controlled subject and a bimetal 3 arranged to be opposed to the heat receiving part 4a is filled with high heat conductive substance 5 such as silicone grease. Thus, heat absorbed by the heat receiving part 4a from the object being the temperature controlled subject is quickly transmitted to the bimetal 3 through the substance 5. When the temperature of the bimetal 3 rises to a set value or more, the bimetal 3 is deformed to press a moving pin 6, and the movable side contact 9 of a leaf spring 7 is disconnected from a fixed side contact 8 in response to such pressing. Therefore, the responsiveness of the thermostat is remarkably improved and the abnormal temperature fluctuation is prevented.



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CLAIMS

[Claim(s)]

[Claim 1] An object by which temperature is managed, and the heat-receiving section arranged by contacting or approaching A bimetal member which is arranged so that the back of this heat-receiving section, contiguity, or a part may contact, and produces deformation by change of temperature The switching section which performs connection or cutoff of an electric contact following deformation of this bimetal member It is the thermostat equipped with the above and is characterized by filling up with high temperature conductivity material between said heat-receiving sections and said bimetal members.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] This invention relates to the thermostat used in order to prevent the unusual temperature rise of the anchorage device in electrophotography-type image formation equipment, concerning the thermostat which performs initiation or a halt of electric supply, when the temperature of the body with which fluctuation of temperature is managed, or material crosses tolerance.

[0002]

[Description of the Prior Art] In image formation equipments, such as a copying machine using an electrophotography method, it is established and the toner image imprinted on the record sheet is used as a permanent image. As this fixing method, the solvent establishing method, the pressure fixing method, and the heating establishing method are used conventionally. Among these, a solvent evaporates and emits and the solvent establishing method has the defect in which the odor gives displeasure. Moreover, a pressure fixing method has a problem on the economy that fixable is bad and must use an expensive pressure sensitivity toner still like a capsule toner compared with other establishing methods. For this reason, in the present condition, the heating establishing method for neither describing [above] a solvent establishing method nor the pressure fixing method coming to spread widely, and carrying out welding of the toner on a record sheet with heating is adopted widely.

[0003] Although there are various things as equipment which enforces this pressurization establishing method, generally the thing of a heating mechanical control by roller is used. This kind of equipment is equipped with the heating roller 101 and the pressurization roller 102 as shown in drawing 4, and the principal part consists of mold release layers 105 with which a heating roller 101 covers the core 103 of the shape of a metal cylinder, the heaters 104 formed in this interior, such as an infrared lamp, and the peripheral face of a core 103. It is prepared so that the toner on a form may not adhere to the peripheral face of a core 103, and this mold release layer 105 is a fluororesin and HTV (High Temperature Vulcanization) as that material. Silicone rubber or RTV (Room Temperature Vulcanization) Heat-resistant materials, such as silicone rubber, are used. Moreover, the above-mentioned core 103 is formed with aluminum, an aluminium alloy, steel, a steel alloy, copper, or a copper alloy. Moreover, the thermo sensor 110 which detects the skin temperature of a heating roller 101 is formed in a heating roller 101 and the location which counters, and ON/OFF of a heater 104 is controlled by the control unit 111 based on the detected temperature. Thereby, a heating roller 101 is controlled by predetermined temperature.

[0004] On the other hand, the pressurization roller 102 is arranged almost in parallel so that a pressure welding can be carried out to a heating roller 101, and it is equipped with the core 106 of the shape of a cylinder which consists of a metal, and the heat-resistant elastic body layer 107 covered by the periphery of a core 106. And the pressure welding of a heating roller 101 and the pressurization roller 102 is carried out, and the rotation drive of either is carried out at least. Thereby, the record sheet 109 which supported the non-established toner image 108 is pinched and conveyed among both rollers. At this time, a toner dissolves with the heat transmitted from a heating roller 101, and contact pressure is stuck by pressure on a record sheet 109.

[0005] This heating mechanical control by roller can be established at high speed while thermal efficiency is high compared with other heating fixing methods, for example, a hot blast fixing method, and an oven-fusing method, and there is little power used and it ends. Moreover, even when a paper jam arises, a record sheet 109 does not become an elevated temperature from the temperature of a heating roller, but there is an advantage that there is little danger of a fire, and it is most widely used in current.

[0006] In the above anchorage devices, since it is necessary to raise the skin temperature of a heating roller 101 even from a room temperature to a temperature required for fixing, even if it turns on a copying machine, the activity of a

copy cannot be performed immediately, but the predetermined warming uptime is needed. This time amount is long in comparison, and, generally necessity about 1 to 10 minutes. As this cure, while making the heat capacity of a heating roller small, it becomes possible by switching on all possible high currents first to shorten a warming uptime at 10 - 30 seconds. However, if a warming uptime is shortened in this way, the temperature of a heating roller will rise rapidly and will become very as rapid [the rate of temperature rise] as 5-15 degrees C/sec.

[0007] Moreover, in the above anchorage devices, a heating roller 101 may be heated beyond control temperature with the malfunction of a thermal control circuit, and poor open-circuit and short circuit / setting location of a sensor 110. In order to avoid the situation where a peripheral device breaks at an elevated temperature in this case, or a fire breaks out, it is necessary to prevent that the temperature of a heating roller 101 rises across tolerance.

[0008] It is common to have connected abnormal temperature arresters, such as a thermostat and a thermal fuse, to a heater and a serial as this kind of equipment conventionally. However, if the temperature rise of a heating roller is rapidly performed as described above, the responsibility of an abnormal temperature arrester etc. influences and the actuation may not be performed correctly. That is, even if the heating roller is an elevated temperature unusually, an abnormal temperature arrester cannot follow the temperature, but after a heating roller goes up to the temperature with which paper burns, the problem that an abnormal temperature arrester operates occurs. Such a problem has the orientation especially to be easy to generate on the occasion of the warming uptime at the time of copy initiation.

[0009] Considering the responsibility over the above abnormality temperature rises, since the live part is exposed, from a heating roller, almost all thermal fuses must detach only a suitable distance, and must be installed. Moreover, in some which have not been exposed, there is a defect that thermal conductivity worsens by the insulating member. For this reason, generally the direction of a thermostat is excellent.

[0010] In the above-mentioned anchorage device, as shown in drawing 4 , the thermostat 120 is connected with the heater 104 at the serial, and it is installed in the peripheral surface of a heating roller 101, and the location which counters. The fixed cap 114 is formed so that this thermostat 120 may cover the disk attachment component 112, as shown in drawing 5 , and convex heat-receiving section 114a is formed in that fixed cap 114. Moreover, the fixed cap 114 is adjoined, the disk-like bimetal 113 is formed, and the migration pin 116 supported possible [an attitude] in contact with this disk-like bimetal is formed. And it is installed so that heat-receiving section 114a may approach with a heating roller 101.

[0011] With such a thermostat, heat is transmitted to the disk-like bimetal 113 through heat-receiving section 114a from a heating roller 101. And the internal stress resulting from the difference of coefficient of linear expansion is accumulated in the disk-like bimetal which curved to convex when the temperature of disk-like bimetal rose, and if it becomes a certain laying temperature, it will deform so that the curve direction may be reversed. By change of the configuration, a migration pin works and the electric contact of the switching section is intercepted. Thereby, the electric supply to a heater 104 is stopped and it is prevented that a heating roller 101 is heated more than it.

[0012]

[Problem(s) to be Solved by the Invention] However, with the above-mentioned thermostat 110, it shall be easy to produce deformation and the configuration of disk-like bimetal will be made by the opening between heat-receiving section 114a. Although the temperature of heat-receiving section 114a rises comparatively rapidly in response to the heat from a heating roller 101, since the opening exists, this opening acts as a thermal break, and heat transfer from heat-receiving section 114a to the disk-like bimetal 113 is not performed efficiently. For this reason, the temperature rise of the disk-like bimetal 113 becomes very later than the heat-receiving section, and has the problem of worsening responsibility of a thermostat.

[0013] It is offering the thermostat which can avoid changing more than the range which can permit the temperature of the body which this invention's is made in view of the above troubles, the purpose's can transmit the temperature fluctuation to bimetal quickly when the temperature of the heat-receiving section is changed, and is set as the object of temperature management, or material.

[0014]

[Means for Solving the Problem] In order to solve the above-mentioned technical problem, invention concerning this application An object by which temperature is managed, and the heat-receiving section arranged by contacting or approaching, A bimetal member which is arranged so that the back of this heat-receiving section, contiguity, or a part may contact, and produces deformation by change of temperature, In a thermostat which has the switching section which performs connection or cutoff of an electric contact following deformation of this bimetal member It shall fill up with high temperature conductivity material between said heat-receiving sections and said bimetal members.

[0015] Objects by which said temperature is managed are a body, material, etc. used as a source of heat transfer for performing control by actuation of a thermostat, and a member, a portion, etc. in various equipment and devices are

included. Said bimetal member has that to which deformation advances gradually in connection with a temperature change, and a curved configuration, and when there is a predetermined temperature change, it contains what the curve direction reverses. A return when connection or cutoff is performed may be performed by actuation from the outside that said switching section should just be that to which either [at least] connection of an electric contact or cutoff is performed when a bimetal member deforms by temperature change. Moreover, both sides of connection and cutoff may be performed by deformation by temperature change of a bimetal member. A soft elastic member which produces deformation by high viscous fluid, grease-like material, and very few force can be used for said high temperature conductivity material.

[0016] Since the invention in this application has the above configurations, it acts as follows. With the above-mentioned thermostat, since it fills up with high temperature conductivity material between the heat-receiving section and a bimetal member, if the heat-receiving section is heated by heat from an object heated, heat will be quickly transmitted to a bimetal member through high temperature conductivity material. For this reason, the heat responsibility of a thermostat can improve, a temperature change of an object by which temperature is managed can be detected accurately, and before changing temperature too much, initiation or a halt of electric supply can be performed.

[0017]

[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained based on drawing.

Drawing 1 is the outline cross section showing one gestalt of operation of the thermostat concerning this invention. This thermostat was held between the cylinder-like housing 1, the disk attachment component 2 which fixed at this end, the fixed cap 4 attached so that this disk attachment component may be covered, this fixed cap 4, and the above-mentioned disk attachment component 2, contacted the back of the disk-like bimetal 3 by which near the center section was formed in convex, and this disk-like bimetal 3, and is equipped with the migration pin 6 supported possible [an attitude] in the direction of an axial center. Furthermore, the above-mentioned fixed cap 4 has heat-receiving section 4a projected near the center section, and while being arranged so that this heat-receiving section 4a and the height of bimetal 3 may double a location, it fills up with the high temperature conductivity material 5 between this heat-receiving section 4a and bimetal 3.

[0018] Moreover, the flat spring 7 of the shape of U character fixed by the end is arranged in the location in contact with the other end of the above-mentioned migration pin 6, the above-mentioned migration pin is contacted at the non-fixed-end side of this flat spring 7, and the moving contact 9 is formed in the edge. On the other hand, a fixed contact 8 fixes inside housing 1, and the pressure welding of a fixed contact 8 and the moving contact 9 is carried out by the energization force of a flat spring 7. This flat spring 7 and fixed contact 8 are connected to the power supply which is not illustrated through the end-connection children 11 and 12. The actuation member 10 for a return is formed in the back side of a flat spring 7, and point 10a penetrates the fixed-end side of a flat spring 7, and is contacted by the migration pin 6 through the non-fixed-end side of a flat spring 7. Thereby, the migration pin 6 can be pressed and it can be made to move to the original condition now. .

[0019] If the above-mentioned disk-like bimetal 3 goes up beyond the set point with temperature, the curve side which serves as convex at the heat-receiving section side is reversed, it deforms so that a heat-receiving section side may serve as a concave, and this temperature is set as 150 degrees C. It is hard to generate rust, such as aluminum and stainless steel CHIRU, and the above-mentioned fixed cap 4 is formed with the metallic material which has high temperature conductivity.

[0020] As the above-mentioned high temperature conductivity material 5, the high temperature grease 15x10⁻⁴cal/**, and more than sec-cm or the heat-resistant rubber of a low degree of hardness has desirably good thermal conductivity more than 5x10⁻⁴cal/**, and sec-cm. In this example, thermal conductivity uses the silicone grease (trade name G746 by the Shin-etsu chemistry company) of 20x10⁻⁴cal/**, and sec-cm as high temperature conductivity material 5.

[0021] With such a thermostat, it is contacted, or approached and arranged at the object for which temperature management which heat-receiving section 4a does not illustrate is performed, for example, a heating roller, and heat is transmitted to the disk-like bimetal 3 through the high temperature conductivity material 5 from this heat-receiving section 4a. If the temperature of this disk-like bimetal 3 rises beyond the set point (150 degrees C), as shown in drawing 2 , a convex bend deforms a concave, by change of that configuration, the migration pin 6 will follow and a flat spring 7 will be pressed. Thereby, the moving contact 9 of a flat spring 7 separates with a fixed contact 8, and the electric contact connected with a power supply (not shown) is intercepted. For this reason, it is prevented that the object of temperature management goes up to the temperature more than tolerance, and danger, such as a fire, is avoided.

[0022] On the other hand, if the temperature of the object of temperature management becomes to some extent low, the depression of the actuation member 10 for a return will be carried out. By this, point 10a will press the migration pin 6 through a flat spring 7, the point of the migration pin 6 will press the disk-like bimetal 3 further, and it returns to the

original condition which the curve direction of bimetal 3 reverses and is shown in drawing 1 . By such actuation, a thermostat returns to the original condition and energization of it is attained.

[0023] In order to check the effect of such a thermostat, the result of the temperature rise test performed by equipping the thermostat shown in the heating roller of the anchorage device shown in drawing 4 at above-mentioned drawing 1 and the conventional SEMO stat is shown. Here, as a heating roller, a fluororesin (Teflon: registered trademark of Du Pont) is covered with the thickness of 30 micrometers to an iron core with a diameter [of 20mm], and a thickness of 0.2mm, and what arranged the quartz lamp in the interior as a heat source is used. The above-mentioned thermostat is arranged so that it may approach with the peripheral surface of this heating roller.

[0024] Drawing 3 shows the relation between the skin temperature of a heating roller, the resistance welding time, and the time amount at the time of actuation of a thermostat in the above-mentioned temperature rise test. As shown in this drawing, it was after about 25 seconds that the thermostat concerning the invention in this application operated, and the skin temperature of the heating roller in that case was 280 degrees C. On the other hand, when the temperature rise test of a heating roller was similarly performed using the conventional thermostat as shown in drawing 5 , it is after [of an after / energization] about 35 seconds that the thermostat operated, and the skin temperature of the heating roller at this time amounted to 350 degrees C.

[0025] Thus, when the skin temperature of a heating roller rose at 350 degrees C, it fumes, there is a danger that paper will burn, and the surrounding components of a heating roller needed to carry out heat deformation, and components needed to be exchanged. On the other hand, the skin temperature of a heating roller did not produce emitting smoke etc. at about 280 degrees C, and all the components were reusable. Therefore, with the above-mentioned thermostat, a heating roller is maintained to a suitable temperature and it becomes possible to control heating temperature appropriately so that neither the emitting smoke by heating to abnormal temperature nor combustion of paper arises.

[0026] In addition, although the thermostat was used in the above-mentioned temperature rise test in order to prevent an abnormal temperature rise in anchorage devices, such as an electrophotography copying machine, it is possible to use it for the equipment at large which is not limited only to an electrophotography copying machine and performs other temperature control. Furthermore, in order to hold uniformly the temperature of the body set as the object of temperature management, or material, this thermostat is possible also for using as a thermo sensor which carries out the on-off control of the source of heating, and can perform precise control using the above-mentioned thermostat.

[0027]

[Effect of the Invention] The thermostat of this invention can make the heat from a heating object able to transmit to a bimetal member correctly quickly from the heat-receiving section, and can improve the responsibility of a bimetal member sharply. Therefore, although set as the object of temperature management, temperature can be correctly controlled in the small range with error to control temperature, and unusual temperature fluctuation can be prevented. For this reason, danger, such as a fire, can be prevented accurately quickly and damage by the heat of other surrounding members can also be prevented certainly.

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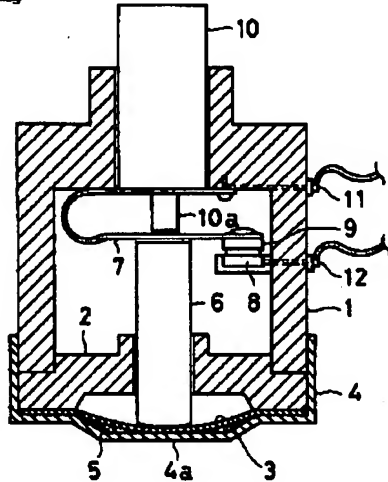
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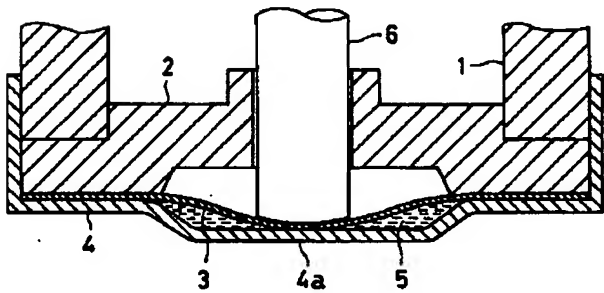
DRAWINGS

[Drawing 1]

(a)

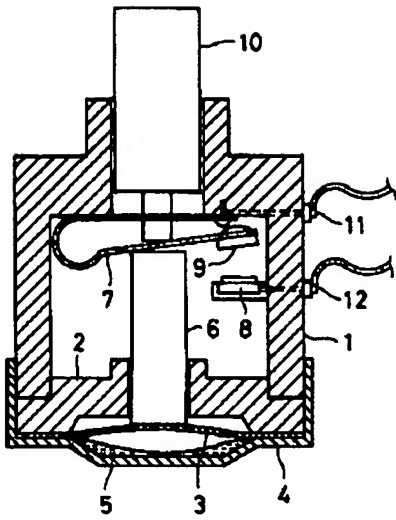


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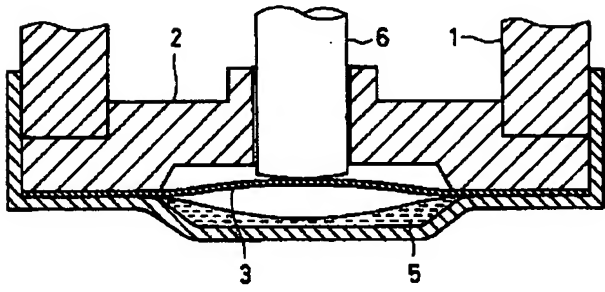


[Drawing 2]

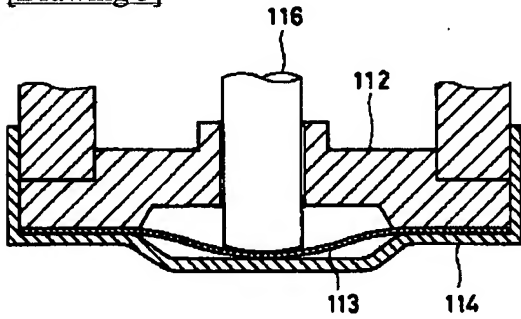
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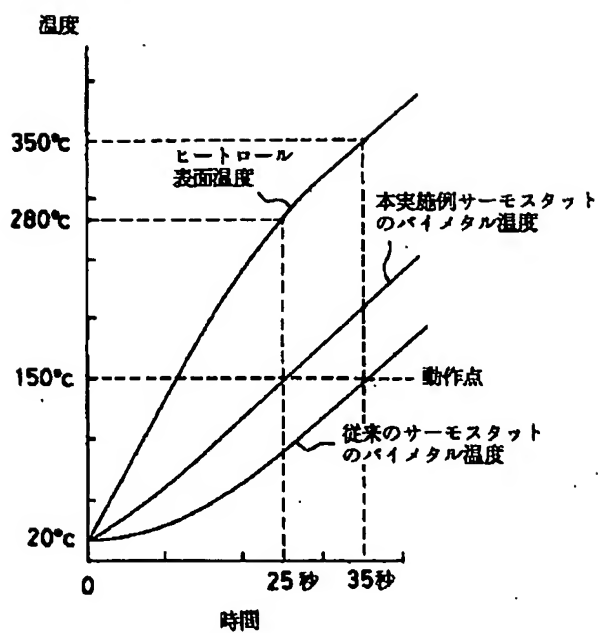
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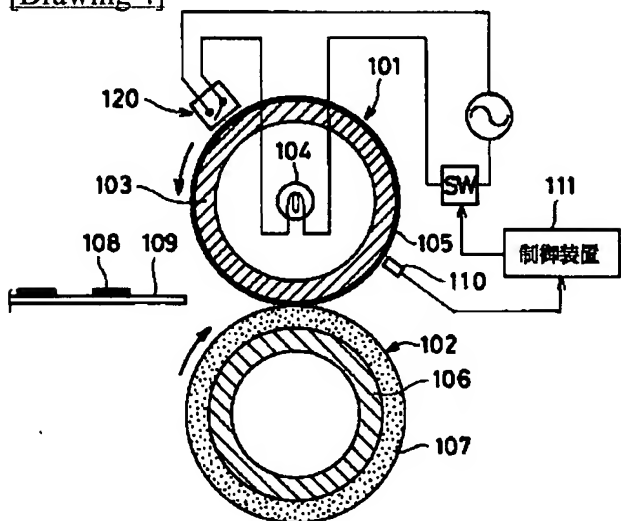
[Drawing 5]



[Drawing 3]



[Drawing 4]



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